COMPARISON OF DRY AND WET SEASON ICHTHYOFAUNA DIVERSITY IN THE RIO CLARO

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Abstract. The ichthyofauna of the Rio Claro in Corcovado National Park includes both freshwater and marine fish species. Marine species are abundant during the rainy season when food resources are high. Winemiller (1983) hypothesized that during the dry season when food resources are less abundant, marine species richness and abundance may decrease due to competition by native freshwater species. We tested Winemiller's hypothesis by sampling during the dry season and found no evidence to suggest a decrease in marine species abundance . This finding suggests that marine species may out compete freshwater species in both wet and dry seasons.

INTRODUCTION

The Rio Claro, a small tidally influenced river, empties into the Pacific Ocean in Corcovado National Park, Costa Rica. Following Winemiller's (1983) classification, there are three types of fish in the Rio Claro: freshwater, peripheral division (marine fishes that live in fresh or brackish waters for variable periods of time), and marine. During the rainy season when allochthonous food input is high, marine species are abundant at both the brackish mouth of the Rio Claro and at a freshwater pool one kilometer upstream. In the 1982 rainy season, Winemiller (1983) found five marine fish species and two peripheral species at the mouth of the river and seven marine species, five peripheral species, and two freshwater species at the freshwater pool site. Winemiller hypothesized that during the dry season, when marine and freshwater fishes' food resources are less abundant, marine fish species richness and abundance may decrease due to out competition by native freshwater fish species. To test Winemiller's hypothesis, we examined the fish fauna in the Rio Claro during the dry season.

METHODS

We conducted our study of fish diversity in the Rio Claro on 3 February 1995. We measured richness and relative abundance of fish at the mouth and in a freshwater pool one kilometer upstream. We visually surveyed fish diversity by snorkeling along four 40 m transects, each 5 m apart, at the mouth of the Rio Claro, and three 53 m transects, one mid-river and one along each bank, at the freshwater pool site. Fish were identified according to Winemiller's (1983) species lists and Bussing (1987). We grouped each species according to abundance: abundant (11-100+ individuals per site), intermediate (2-10 individuals per site), or rare (1 individual per site). We collected water samples at both sites and measured salinity with an American Opticrs refractometer.

RESULTS

At the freshwater pool site, the two peripheral species had the same abundance in the wet and dry seasons (Table 1). Two of the five marine species increased in abundance from the wet to the dry season, two species decreased in abundance, and one species remained moderately abundant. The two freshwater species abundant in the wet season (Winemiller 1983) were not found in our dry season samples (Table 1).

At the mouth of the Rio Claro, we found no peripheral species and three marine species as compared to the two peripheral species and five marine species found in the wet season (Table 2). The unidentified species found at both sites had a diagonal black stripe through each eye.

Salinity at the freshwater pool was 0 ppt. Salinity at the Rio Claro mouth was 4.5 ppt.

TABLE 1. Wet and dry season abundance of fish species at a freshwater pool in Rio Claro, Corcovado (A-abundant, 11-100+ individuals; I-intermediate, 2-10 individuals; R-rare, 1 individual; NF-no individuals found).*

Species	Wet season abundance	Dry season abundance
Freshwater species		
Brachyrhaohis rhabdophora	A	NF
Astyanax fasciatus	A	NF
Peripheral species		
Anaous transandeanus	A	A
Centropomus undecimales	I/A	A
Sicydium pittieri	A	NF
Eleotris picta	A	NF
Gobiomorus maculatus	A	NF
Marine species		
Pomadasys bayanus	I	A
Eucinostomus sp.	I	A
Lutjanus argentiventris	I	I
Mugil curema	A	I
Sphoeroides annulatus	I	R
Lutjanus colorado	A	NF
Lutjanus novemfasciatus	A	NF
Unidentified sp. 1	-	A

* Wet season data from Winemiller (1983)

TABLE 2. Wet and dry season abundance of fish species at the mouth of Rio Claro, Corcovado (A-abundant, 11-100+ individuals; I-intermediate, 2-10 individuals; R-rare, 1 individual; NF-no individuals found).*

Species	Wet season abundance	Dry season abundance
Peripheral species		
Centropomus undecimales	I/A	NF
Bathygobius andrei	A	NF
Marine species		
Pomadasys bayanus	NF	A
Eucinos tonus	NF	A
Mugil curema	A	I
Sphoeroides annulatus	I	NF
Lutjanus colorado	A	NF
Lutjanus novemfasciatus	A	NF
Gobionellus sagittula	A	NF
Unidentified sp. 1	-	R

* Wet season data from Winemiller (1983).

DISCUSSION

Although sample sizes were too small for statistical analysis, comparison of ichthyofauna diversity in the Rio Claro during the wet and dry seasons suggests there may be no decrease in marine species diversity from the wet to the dry season. Our sampling methods were more limited than those of Winemiller's study. Because, we spent less time sampling and used fewer sampling techniques, we expected to find fewer species and individuals than Winemiller. Since richness estimates are often influenced by sampling methods, we limited the comparison of wet and dry season diversity to the relative abundance of species common to both studies. Since abundance was probably underestimated, rare and intermediate species may actually be more abundant than indicated. This potential bias would only strengthen our finding that marine species remain abundant in the dry season.

Marine and peripheral species abundance at the upstream site appeared to change little with season (Table 1), while those at the mouth of the river showed more seasonal change (Table 2). Two of the three marine species at the mouth increased in abundance from being absent in the wet season to being abundant in the dry season. One marine species decreased in abundance from the wet to the dry season (Table 2). A 1983 map of the Sirena region shows a large island in the lagoon at the mouth of the Rio Claro (Winemiller 1983), but this island no longer exists. This change in habitat since Winemiller's study may help to explain at least some of the apparent changes in abundance.

Winemiller found a total of 12 marine and peripheral species and only two freshwater species at the upstream site. In terms of both species richness and relative abundance, marine and peripheral species were dominant at the upstream site during the wet season (Table 1). If the marine and peripheral species were competitively dominant in the wet season, they might maintain dominance in the dry season, regardless of decreases in overall food availability and stream volume. Since marine and peripheral species abundance

remained high, and we found no freshwater species, our study suggests that marine and peripheral species are competitively dominant to freshwater species in the dry season.

Further studies should investigate the factors which allow marine species to dominate in a freshwater environment. Possible factors include low diversity of indigenous freshwater species, high availability of food resources utilized by marine species, and close proximity to the ocean.

LITERATURE CITED

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